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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/546,213	04/10/2000	Atsushi Watanabe	392.1682/JDH	3616

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EXAMINER	
SETH, MANAV	

ART UNIT	PAPER NUMBER
2625	

DATE MAILED: 03/13/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 09/546,213	Applicant(s) WATANABE ET AL.	
	Examiner Manav Seth	Art Unit 2624	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *11 January 2006*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-14* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-14* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

5) ☐ Notice of Informal Patent Application (PTO-152)

6) ☐ Other: _____.

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1 .17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on January 11, 2006 has been entered.

Response to Amendment

2. Applicant's amendment under 37 C.F.R. 1.16 filed on January 11, 2006, has been entered in full.

3. Applicant's arguments on pages 7-13 in amendment filed January 11, 2006, with respect to the rejected claim(s) 1-14 under 35 U.S.C. 103(a) respectively, have been fully considered but are not persuasive. See the detailed discussion in section entitled in **"Claim Rejections"** and **"Response to Arguments"**.

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

5. Claims 1, 3, 4 and 8-14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Spight (USPN 4,462,046) in view of Corby, Jr. et al. (USPN 5,745,387, hereafter Corby).

Regarding claims 1 and 8, Spight discloses a teaching model generating method and device for image processing, in which a subject object has the same or substantially similar shape as that of a reference object (column 1, line 7-12), the device comprising: an image processing system with which current three-dimensional orientation of the subject object relative to an image pickup device is recognized based on a plurality of predetermined teaching models (stored data of desired object) of the reference object (column 3, line 26-47; column 8, line 10-15); and an image-capture system (video detector 40, Figure 1; column 5, line 42-48), in advance of the recognizing, generating and storing the plurality of teaching models (reference signals) on the basis of respective image data produced by taking images of said reference object from a plurality of directions, so that the image data respectively obtained at each of said different image pickup positions, is stored as a teaching model (reference signal) (column 9, line 1-19). Spight discloses "the present invention relates to use of optical processing for a programmable industrial automation system wherein **object identification**, location, and **orientation** may be determined" (col. 1, lines 7-12) and further discloses **robotic** vision system which is capable of near real-time sensing and analysis, **to identify** and determine the location and **orientation** (direction) of workpieces in realistic batch manufacturing environment (col. 1, lines 39-44; col. 1, lines 55-60). Spight further discloses that in order to produce real-time identification and determination of location and orientation of parts (object), **a viewed representation of the object is compared (pattern matching as it is done by**

the processor) with a stored representation of the desired objects (apparently has to be similar shape objects) (col. 1, lines 60-65; col. 2, lines 10-35). From the above disclosure by Spight, it is clear that the stored image data is nothing but a plurality of teaching models based on the image data of the reference object taken earlier or previously, that are required to determine **the identity, position and orientation** of the object in real-time, without which there would be no real time processing and examiner further asserts that Spight teaches a robotic vision system with a camera (col. 1, lines 65-68 through lines col. 2, lines 1-5) but Spight does not specifically disclose that one of the reference object and said image pickup device is fixed to a movable and positionable part of the robot or is grasped with a hand of the robot, that said robot is operated for positioning to a plurality of different image pickup positions and directions, or that direction information indicating the respective different direction is stored with the image data as a teaching model.

However, Corby discloses an augmented reality maintenance system employing a manipulator arm with an archive and comparison device wherein a distal end 100 of the manipulator arm 10 is attached to a utility package 11, which may include a spatial imaging device such as a video camera (Figure 1; column 4, line 18-33). Corby also discloses a position and attitude sensing unit 21 to determine the position and orientation distal end 10b, which can then be used by manipulator arm renderer 33 to create several images of a prestored model of the manipulator arm from model storage 47 from several different viewpoints and environment renderer 35 to produce a number of images of the environment corresponding to supplied viewpoints (column 4, line 34-65). Corby goes on to disclose an archive and comparison device 50 that utilizes a sensor data storage device 51 capable of storing spatial imagery with location, orientation and acquisition parameters linked to each image (column 6, line 29-37). Corby clearly teaches a robotic manipulator arm 10 which has a camera installed at the movable distal end and which is further used to render the environment

which further includes the inspection of machines and structures as defined in (col. 1, lines 32-40; col. 4, lines 22-34) and inspection of structures as well-known being a part of manufacturing process and here is done using the same technique of taking images at different viewpoints as described by Spight. Corby clearly teaches "Presently this is accomplished by moving the manipulator arm to a particular position (viewpoint or orientation) and videotaping the structure or device (reference object of similar shape) which is to be examined". At a later date the manipulator arm is positioned at the same site and current data (such as a video image) is compared to previous data" (col. 1, lines 55-65; col. 6, lines 8-30- done manually; col. 6, lines 30-68 through col. 7, lines 1-25-using a system) and **it would be apparent to one of ordinary skill in the art that if the same structure is to be inspected again, it has to be identified before it is examined/inspected** and Corby clearly teaches moving the camera at a viewpoint. Corby further provides teachings of generating images at different orientations or directions (viewpoints) (col. 2, lines 33-40; col. 2, lines 45-52; col. 6, lines 8-30- done manually; col. 6, lines 30-68 through col. 7, lines 1-25-using a system), which are further stored and used as teaching models based on the image data (col. 4, lines 66-68 through col. 5, lines 1-2; col.. 6, lines 10-68). Corby further clearly teaches "**the sensor device 51 capable of storing spatial imagery with location, orientation and acquisition parameters linked to each image. These parameters define the identity of the site imaged (object)**, when it was imaged, the viewpoint, the modality of the imager" (col. 6, lines 35-40 with automated positioner). **Further, Corby provides pattern matching in lines 52-67 of col. 6 through col. 7, lines 1-25 where the comparison or matching is done by an archive and comparison device 50, where examiner here asserts that pattern matching is nothing but comparing images by a computer (col. 7, lines 1-20, image comparison, image difference and highlighting the regions are provided by a system), to identify the object as defined both by Spight and Corby.** Therefore, it would have

been obvious to one of ordinary skill in the art at the time the invention was made to fix an image pickup device to a movable and positionable part of a robot, operate the robot for positioning to a plurality of different image pickup positions and directions, and store direction information indicating the respective different direction with the image data as a teaching model as taught by Corby in order to define the identity of the site imaged, when it was imaged, the viewpoint, the modality of the imager and description of values relating to the image (column 6, line 37-51) and more emphasis added, to further enhance the object identification when object is viewed at different directions or viewpoints, keeping in view the 3 dimensional structure of the object, in real-time and further both references are directed to robotic industrial automation.

Note also that Spight does not explicitly disclose that the recognized current orientation of the subject is three-dimensional (determine object's position and orientation <u>in space</u>; column 8, line 10-15) and Corby only mentions it in passing (column 2, line 6-12; column 8, line 41-45). The examiner takes Official Notice that determining three-dimensional orientation of an object is well known in the art of robotic vision systems. It would have been obvious to one of ordinary skill in the art at the time the invention was made to determine the three-dimensional orientation of an object in order to determine the orientation at which to pick up an object.

Regarding claim 3, Spight discloses that said teaching model is a part of the image data of the reference object (column 9, line 10-19; column 10, line 50-63).

Regarding claim 4, Spight discloses that said teaching model comprises data obtained by performing image processing on the image data of the reference object (column 9, line 10-19; column 10, line 50-63).

Regarding claims 9 and 12 (see above discussion of claim 1), Spight discloses a method of automatic orientation recognition, comprising: generating and storing a set of images of different relative orientations (arrangements; claim 12) of a subject (column 9, line 1-19), the images having been captured by a plurality of robotic operations corresponding to the different relative orientations (arrangements) of the subject (Corby; column 4, line 43-65; lines 52-67 of col. 6 through col. 7, lines 1-25), and associating with each image information indicating its respective relative orientation (arrangement) of the subject (Corby column 6, line 29-51; lines 52-67 of col. 6 through col. 7, lines 1-25); after the generating and storing, from a known current orientation (arrangement) of (an image pickup device on) a robot, capturing a current image of a workpiece that has an unknown orientation (arrangement) relative to an image pickup device on the robot (Corby; column 4, line 18-33) (before the robot has come into contact with the workpiece; claim 9 only), where the workpiece has a shape substantially similar to the shape of the subject (Spight; column 3, line 29-38; column 6, line 11-13); after the capturing, using pattern matching (correlation) to match one of the stored images with the current image (column 7, line 28-column 8, line 15; column 9, line 59-column 10, line 11); and after the pattern matching, (and before the robot has come into contact with the workpiece; claim 9 only), determining the orientation (arrangement) of the workpiece relative to the image pickup device on the robot based on the relative orientation (arrangement) information associated with the matched stored image (reference signal), and also based on the known current orientation (arrangement) of the robot (column 8, line 16-37; column 11, line 21-38).

Regarding claim 10, Spight discloses automatically maneuvering the robot to the workpiece based at least on the determined orientation of the workpiece relative to the robot (column 8, line 16-37).

Regarding claim 11, Spight discloses that the generating and storing is performed for a plurality of differently shaped subjects (store a plurality of configurations of <u>each</u> desired object; column 9, line 1-19), wherein the current image includes a plurality of differently shaped workpieces, and wherein the pattern matching further comprises identifying workpieces from among the plurality of differently shaped workpieces using the images and orientation information of the plurality of differently shaped subjects (column 6, line 11-13; column 7, line 50-column 8, line 15; column 11, line 29-38).

Regarding claims 13 and 14 (see above discussion of claim 1), Spight discloses a method comprising: robotically taking images of a subject with different three-dimensional subject-camera arrangements that vary in three dimensions (column 9, line 1-19; Corby, column 4, line 17-33), and associating with each image or data thereof information indicating its subject-camera arrangement (Corby, column 6, line 29-51); then taking a current image of a workpiece shaped like the subject (Spight; column 3, line 29-38; column 6, line 11-13); and then before picking up the workpiece determining a current workpiece-camera orientation by matching (correlating) one of the images or data thereof with the current image (Spight, column 7, line 28-column 8, line 35; column 9, line 59-column 10, line 11), and using predetermined subject-camera arrangement information of the matched image to determine the three-dimensional orientation of the workpiece relative to the camera (Spight, column 8, line 16-37; column 11, line 21-38).

6. Claims 2, 5 and 6 are rejected under 35 U.S.C. 103(a) as being unpatentable over Spight in view of Corby and further in view of Werth et al. (USPN 4,504,970, hereafter Werth).

Regarding claim 2, Spight discloses a teaching model generating device for image processing, in which a subject object has same or substantially similar shape as that of a reference object, the device comprising: an image processing system with which a current three-dimensional orientation of the subject object relative to an image pickup device is recognized by carrying out pattern matching processing of an image of the subject based on a plurality of pre-determined teaching models of the reference object; and an image capture system, in advance of the recognizing, generating and storing the plurality of teaching models on the basis of respective image data produced by taking images of said reference object from a plurality of directions, wherein said image pickup device is fixed to a movable and positionable part of a robot or is grasped with a hand of the robot, which is operated for positioning to a plurality of different relative image pickup positions and directions, so that the image data respectively obtained at each of said different image pickup positions is stored as a teaching model (see above discussion of claim 1).

Neither Spight nor Corby discloses that the reference object is fixed to a movable part of a first robot or is grasped with a hand of the first robot. Werth discloses a training controller for pattern processing system wherein it is suggested that an application could utilize two robot arms, one which holds a camera which visually guides it to observe a precise assembly point and a second which brings a tool or assembly within the visual field of the camera where it is visually guided through an operation (column 5, line 12-17). It would have been obvious to one of ordinary skill in the art at the time the invention was made to utilize two robot arms, one to hold a camera and one to hold a tool or assembly as taught by Werth in order to provide more degrees of freedom allowing more views of the workpiece from different directions and to provide proper alignment for mating parts in automated assembly operations or move a tool to a specific point on the part (column 5, line 6-11) and more emphasis added, to further enhance the object identification when object is viewed

at different directions or viewpoints, keeping in view the 3 dimensional structure of the object, in real-time and further all the references are directed to robotic industrial automation.

Regarding claim 5, Spight discloses that said teaching model is generated for every direction in which said image pickup device took the image of said reference object (column 9, line 1-19) and Corby discloses that said teaching model is stored in association with the information on the direction (column 6, line 29-41).

Regarding claim 6, Spight discloses that said image pickup device 40 is a camera (column 5, line 42-48).

7. Claim 7 is rejected under 35 U.S.C. 103(a) as being unpatentable over Spight in view of Corby in view of Werth as applied to claim 2 above, and further in view of Ninomiya et al. (USPN 4,611,292, hereafter Ninomiya).

Spight, Corby nor Werth disclose that said image pickup device is a three-dimensional visual sensor that measures a distance between the image pickup means and a plurality of points on the object. Ninomiya discloses a robot vision system including a three-dimensional visual sensor whose image pickup means measures the distance between the image pickup means and a plurality of points on the object (column 4, line 28-49). It would have been obvious to one of ordinary skill in the art at the time the invention was made to utilize a three-dimensional visual sensor as taught by Ninomiya in order to determine the position and posture of an object without operation or accuracy being effected by contrast, color, or surface condition of the object (column 10, line 35-39).

Response to Arguments

8. Applicant's arguments regarding the prior art rejections under Spight and Corby on pages 6-9 of the Amendment filed on April 14, 2005, have been fully considered but are not persuasive.

9. In the 2nd paragraph of the page 9, Applicant argues in substance:

a. Neither Spight nor Corby, Jr et al., teach or suggest that "one of the reference object and said pickup device is fixed to a movable and positionable part of a robot.....for positioning to a plurality of different image pickup position and direction ....[that are] stored as a teaching model" as recited in claim 1, 8, 9 and similarly in claims 12 and 13.

Examiner respectfully disagrees. Examiner maintains the same arguments as made in the previous office action mailed on 09/07/2005 on pages 9-11.

10. In the 2nd paragraph of the page 8, Applicant argues in substance:

b. The newly cited portions of the Background of the Invention section in Corbv, Jr. et al. describe "manipulator arms ... useful for inspection of machines or structures which are in environments which are inaccessible or very hazardous for humans" (column 1, lines 32-34) and the prior art inspection method that was improved upon by Corbv. Jr. et al. "to determine the rate of deterioration,) the manipulator arm is moved to a particular position ... for videotaping the structure or device which is to be examined. At a later date the manipulator arm is positioned at the same site and current data (such as a video image) is compared to previous data" (column 1, lines 55-60). All of this portion of Corbv, Jr. et al. teaches away from using Corbv, Jr. et al. to modify Spight or that Corbv, Jr. et al. is relevant

<u>to the invention, since neither Spight nor the invention are directed to operations in "environments which are inaccessible or very hazardous for humans" or "to determine the rate of deterioration" as in Corbv, Jr. et al.</u>

Examiner respectfully disagrees. Examiner does not rely on Corby to provide teachings on the hazardous environments for humans but to provide the teachings "that one of the reference object and said image pickup device is fixed to a movable and positionable part of the robot or is grasped with a hand of the robot, that said robot is operated for positioning to a plurality of different image pickup positions and directions, or that direction information indicating the respective different direction is stored with the image data as a teaching model". Spight clearly teaches recognizing the object based on a plurality of teaching models in robotic environment and examiner relies on Corby to show the ways the robot can be used to provide the teaching models.

Applicant further argues in substance that "the use of the term "pattern matching" in the application as an operation performed by a device, not a human is consistent with definition of the term in the robot art". Spight clearly teaches the pattern matching using a processor rather than done by an operator or human (col. 8, lines 1-35). Corby clearly teaches the use of archive and comparison (A&C) device for pattern matching (col. 6, lines 30-67 through col. 7, lines 1-25, **image comparison, image difference and highlighting the regions are provided by a system**).

All other arguments regarding all other claims are moot in view of the rejections made above.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Manav Seth whose telephone number is (571) 272-7456. The examiner can normally be reached on Monday to Friday from 8:30 am to 5:00 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Bhavesh Mehta, can be reached on (571) 272-7453. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Manav Seth
Art Unit 2625
March 2, 2006

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